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UTAH'S FERTILE COAL CRESCENT:
A LAND OF PLENTY

By H. H. DOELLING and A. D. SMITH

COAL DEVELOPMENT IN CENTRAL UTAH

Historically, the Fertile Crescent is that narrow strip of land in the Middle East extending from the valleys of the Euphrates and Tigris Rivers across and through the Jordan Valley of Palestine/Israel to the Sinai Desert. It is bounded on all sides by desert and became known as the Cradle of Civilization. Utah has a similar "fertile crescent," which extends along the Book Cliffs northwestward from the Green River and then southwestward along the eastern margin of the Wasatch Plateau to the Fish Lake Plateau, a distance of nearly 130 miles. This narrow strip is not fertile in the agricultural sense, but fertile due to the presence of Utah's highest quality coal. A series of communities has developed along the base of the coal-bearing cliffs in a crescent-shaped valley surrounded by uninhabited steppe or desert. To be sure, Utah has other coal fields with excellent and abundant coal, but historically and at present over 95 percent of Utah's coal production has come, or is coming, from this "fertile crescent," comprised of the Book Cliffs, Wasatch Plateau, and Emery coal fields. In the future the "sleeping giant" of the southwestern Utah coal region (Kaiparowits Plateau, Alton, and Kolob coal fields) may awaken as a major coal producing area (Figure 1). Coal fields in Grand, Uintah, Sanpete, Duchesne, and Summit counties are also often considered for development, but the smaller potential resources, poorer quality, or the structural geology of the coal are expected to hinder their development.

Utah's coal industry is located along this "fertile coal crescent" and it continues to have the longest sustained production in its 111 year history. With most of the "crescent's" 28 active mines reporting, it appears that the 1981 production of coal has exceeded 14.2 million short tons. This all-time coal production record was achieved in spite of a strike, which occurred in the first part of the year, and exceeded the 1980 record by more than 600,000 short tons.

Serious coal mining started in Utah around 1870 in the Coalville area of Summit County, but shifted to the "fertile crescent" in the 1890s. Annual production reached one million short tons by 1900 and has never fallen below that level since. The industry has enjoyed three "booms"; the first lasted from 1915 to 1929 (14 years), during which time an average of 4.7 million tons were produced annually (Figure 2). The Depression of the 1930s caused a production decline from 1930 until 1941 (11 years), which ended with the advent of World War II. During the depresssion years the average annual production rate slipped to 3.2 million short tons.

National wartime needs not only required an increase of industrial coal, but initiated the development of the steel industry in Utah, which greatly expanded Utah's coal market (Figure 3). This second "boom" lasted from 1941 to 1957 (17 years) in which the annual production averaged 6.3 million short tons. Soon after 1950, competition from petroleum and natural gas began to make serious inroads into the industrial, com-

(see page 6)

1982 Symposium on the Geology of Rocky Mountain Coal

The Utah Geological and Mineral Survey, the Utah Geological Association, the U.S. Geological Survey, the Colorado Geological Survey, and the Energy Minerals Division of the American Association of Petroleum Geologists are sponsoring the ***Fifth Symposium on the Geology of Rocky Mountain Coal***. The two-day symposium will be held in Park City, Utah, on May 12 and 13, 1982. About 30 papers concerning the geology of coal in the Rocky Mountain, Northern Great Plains and Pacific Coast provinces will be presented during the conference. The symposium will be followed by a two-day field trip to the coal fields of central Utah where underground mine geologic studies and depositional modeling investigations will be reviewed. Preregistration for the field trip and the symposium is requested.

For further information contact:
Jerry E. Vaninetti, Program Chairman
Norwest Resource Consultants, Inc.
10 Exchange Place
Salt Lake City, Utah 84111
(801) 364-5343

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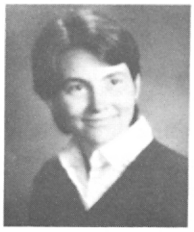


FROM THE DIRECTOR'S DESK

COAL VERSUS BUFFALO IN THE HENRY MOUNTAINS

The coal bearing Cretaceous Mancos Group that outcrops near Ferron and Emery, Utah, also contains coal in the Henry Mountains area. These coal seams vary in quality thickness and overburden thickness. Most of the Henry Mountains coal field is administered by the federal government, although the state administered scattered school sections. Coal companies have shown an interest in the Henry Mountains field, and Preference Right Lease Applications (PRLA) for 11,360 acres have been applied for by an AMAX subsidiary, Meadowlark Farms, for three separate mineable units. In November 1981, the BLM completed their *Henry Mountain Coal Unsuitability Study,* in accordance with federal requirements to assess the unsuitability or acceptability for coal leasing and development. The BLM concluded that 18,908 acres of public land should be designated unsuitable for leasing because much of that acreage is visible from a scenic overlook within Capitol Reef, and much of the area is critical winter range for the only free-roaming, hunted, buffalo herd in the conterminous U.S.

The UGMS, as an agency represented on Utah's Coal Leasing Task Force, reviewed the BLM report and concluded that the coal resources, although not well known, are relatively high quality with low sulfur content, and that several areas could be mined economically. Reserves in the Henry Mountains coal field are estimated by H. H. Doelling to be 375.6 million short tons of "measured, estimated, and inferred coal ≥ four feet thick" (*Geology and Mineral Resources of Garfield County*, UGMS Bulletin 107, 1975).

Some areas of the Henry Mountains coal field are more promising for mining than others. The coal field can be divided into three general areas, a northern, a central, and a southern (*see page 3*). The coal in the northern area of the field (north of Tarantula Mesa) is high quality, surface mineable coal. In the central area (south of Tarantula Mesa) the coal is also high quality surface mineable coal, but two of the most promising areas, Swap Mesa and Cave Flat, have been designated as critical habitat for the buffalo. Transportation access is difficult to this area. The southern area of coal deposits is not as economically desirable as the first two areas. The state's school sections are distributed unevenly among the three coal areas (five in the north, eight in the central, and ten in the south).

The UGMS presented the Henry Mountains coal resource statistics to Utah's Coal Leasing Task Force, and also presented the following issues of resource policy:

Sequential Versus Permanent Land Use – Some land developments tie up the land resource forever, others use land only for a limited period of time. Surface mining is a land use which need not disturb the land forever. It is a sequential versus a permanent land use and can be planned as part of the longterm use of land. Land that is primarily used for range, forage, and recreation can be surface mined, rehabilitated, and again used for range, forage, and recreation.

Diversity of a Resource Base – It is unwise of the state to become too dependent of a single or even a limited number of extractive resources. Today virtually all of Utah's coal resources are mined by underground methods from the "fertile crescent" (*see page 1*). As a result, extraction of these high quality coal resources is relatively expensive. Development of surface-mined coal in the Henry Mountains area would diversify the type of coal mined, would provide coal more competitively priced with out-of-state coal, and would develop coal from a geographic region other than the "fertile crescent."

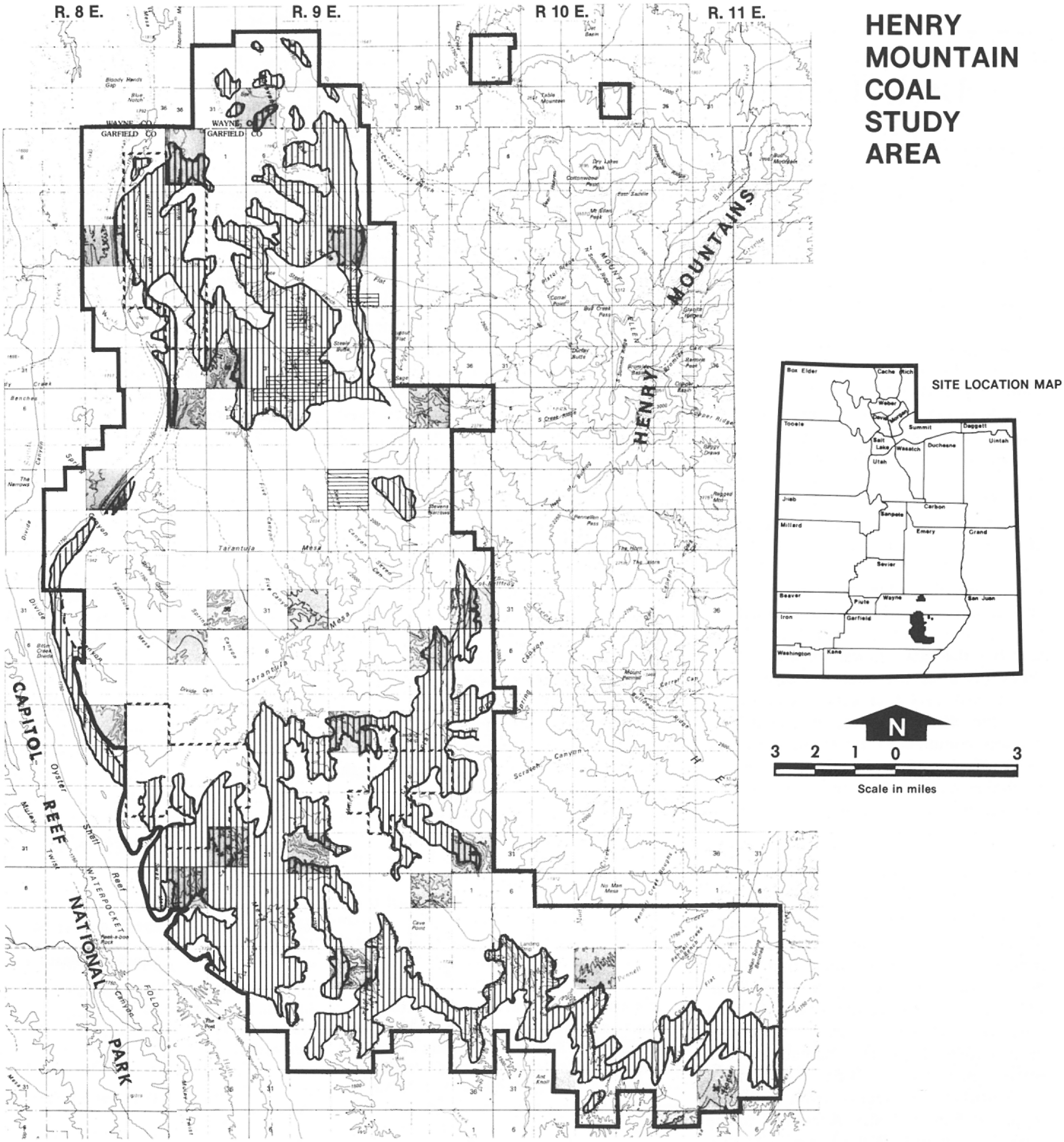
New In-State Markets – The development of large coal-fired projects in Utah will require an expansion of Utah's coal industry, or coal for these projects will be bought from outside the state. The Henry Mountains coal field could provide some of this needed resource.

In November 1981, it looked as if development of Henry Mountains coal would be stopped. After considerable UGMS and DNRE investigation of this controversial issue, the state developed a policy so that coal development could be encouraged in at least part of the coal field.

Governor Matheson recommended to Roland Robison, State Director of the BLM, that the state of Utah divest its sections in the central and southern areas of the coal study area and exchange and consolidate them in the northern areas. In this way, the state would block out a leaseable area for coal mining and the BLM would manage the central and southern coal areas for scenic and wildlife resources. It is the Governor's desire that these areas not be written off in perpetuity for coal development. By trading off state sections in areas with lesser potential for coal development and blocking them out in the area with a higher potenital for coal development, the state of Utah will undoubtedly be able to accelerate the development of coal in the northern Henry Mountains coal field. If the trade is acceptable to the BLM, this situation which at first presented a potentially controversial and discouraging situation for any coal development in the Henry Mountains, appears to have been resolved to the satisfaction of both mining and wildlife interests.

Genevieve Atwood

HENRY MOUNTAIN COAL STUDY AREA



STATE LAND

PRIVATE LAND

PREFERENCE RIGHT LEASE APPLICATION AREAS

PUBLIC LANDS-BLM (All other)

STRIPPABLE COAL AREAS

Source: U. S. Department of the Interior, November 1981, Henry Mountain Coal Suitability Study: Bureau of Land Management (Richfield District), p. 2; reproduced with permission.

Utah Toponyms By KLAUS D. GURGEL

UTAH "COAL" PLACE NAMES

The study of place names and their interrelationship with other phases of culture may help to illuminate significant aspects of Utah's cultural history, geology and geography. Descriptive toponyms, based on coal-bearing formations and coal mining activities, provide just one example of that man-land ralationship.

Mormon pioneers were the first English-speaking people to attach a coal-related name to Utah's landscape. While exploring Utah's Dixie in the winter of 1849-50 for possible settlement, a Mormon explorer party under the leadership of Parley P. Pratt made the first coal discovery. The coal was found along a stream on the edge of what is today known as the Kolob Plateau Coal field in Iron County. Initially called the Little Muddy, the stream was renamed Coal Creek (**1**) after the coal was discovered. In late 1851, Cedar City was founded near the discovery site, and coal production commenced in a small way by 1852. Despite the generally low quality of the coal and distance from markets, mining in the area continued intermittently but ceased in 1969.

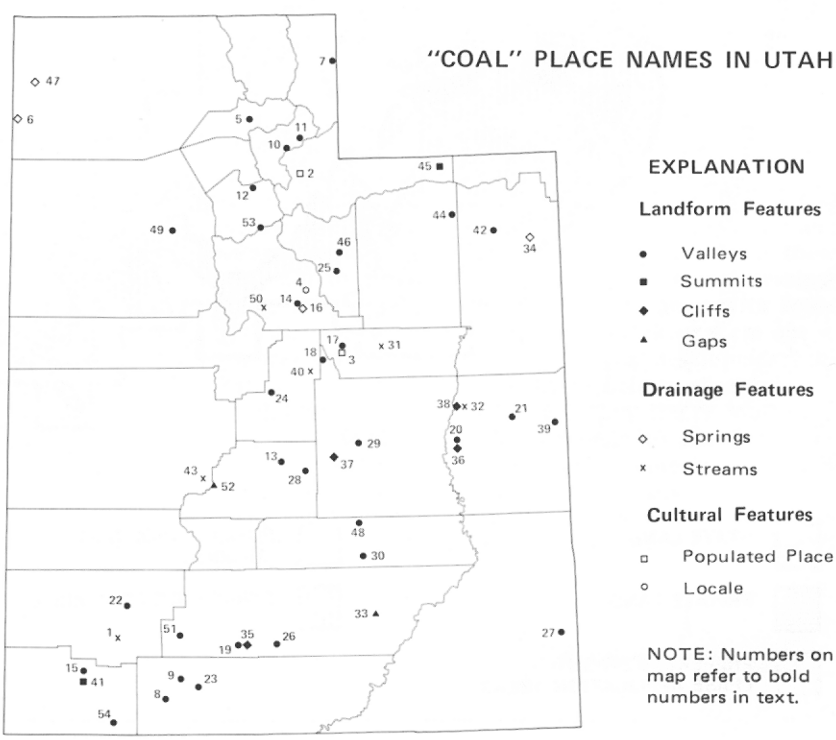
As the pioneers expanded their settlements through Sanpete and Sevier valleys in the early 1850s, two men, J. E. Ruse and John Price, reportedly learned of the Sanpete coal deposits from a Ute Indian who called it "rock that would burn." Sanpete coal was first mined in 1854 at a place called Coalbed, then renamed Coalville and since 1869 it has been known as Wales. Named for the British principality, Wales was settled by Mormon immigrants from the coal mining regions of Wales. According to the 1980 U. S. census, Wales has only 153 inhabitants.

The tremendous influx of immigrants into the Utah Territory during the first decade of settlement intensified the need for fuel, especially in the Salt Lake City area where the bulk of the population had settled (the 1850 U. S. census reported 11,380 inhabitants for the Territory, 1860, 40,273). Coal then was too expensive because of distance to the market place and citizens were generally not yet convinced of its merits. During an address delivered on May 27, 1855 in the Salt Lake Tabernacle, Brigham Young discussed his visit to the Sanpete coal beds and the possibility of shipping coal to Sale Lake if "persons in the city will encourage the business." He then pointed out that "if we turn our attention to coal for fuel, we can easily store away a winter's stock in our cellars, and turn the key upon it, and this will actually make some men practically honest, whereas, if your wood pile is out of doors, they may continue to be dishonest." Coal critics disliked the fuel because of the associated dust, but Brigham Young had some advice for them. Said he: ". . . I will offset that inconvenience with one to which we are subject when burning wood; then our houses are often infested with spiders, bugs, ants, and other insects, which has always been a great annoyance to me. I have often almost dreaded to bring an armful of wood into the house, lest such insects should drop from it."

To meet the growing demand for coal the Territorial Legislature offered a reward of $1,000 to anyone discovering coal within 40 miles from Salt Lake City. The reward was claimed in 1859 when coal was discovered in Summit County by Mormon settlers who established the community of Coalville (**2**) the same year. Coalville eventually became the county seat for Summit County and had a population of 1,031 in 1980. Meanwhile, Coalville has become a center for oil and gas drilling and production in the Thrust Belt region.

Several other communities with "coal" place names occur in Carbon County. The name Carbon is in reference to the vast deposits of coal and hydrocarbon shale within the county. The county was organized in 1894 and extends from the crest of the rich coal-bearing Wasatch Plateau eastward across the coal-rich Book Cliffs to the Green River. The population of Carbon County has always been of diverse ethnic backgrounds and small in numbers, but renewed mining efforts between 1970-80 caused a population increase from 15,647 to 22,179, a 41.7 percent increase. The

(see page 8)



"COAL" PLACE NAMES IN UTAH

NOTE: The author is grateful to H. H. Doelling and J. Van Cott for their advice and help in preparing this article.

MINERAL INDUSTRY ACTIVITY NEWS, November 1981 to March 1982

By MARTHA RYDER SMITH

Beryllium – ***Brush Wellman*** plans to spend $2 million to modify its beryllium extraction plant at Delta in Millard County, to process lower grade beryllium ore from the present 10 percent to 7 percent. This will significantly extend the bertrandite reserves at Spor Mountain.[1]

Cement – ***Martin Marietta Cement's*** Mountain Division has announced the start-up of their new $85 million cement plant and terminal. The plant, located 105 miles southwest of Salt Lake City, in Leamington Valley, Millard County, is the largest cement-production facility in Utah and is expected to produce from 500 thousand to 1 million tons of cement a year. It has been contracted to supply cement for the Intermountain Power Plant near Delta. The quarry at Leamington has sufficient reserves of limestone to last over 100 years.[1]

Coal – ***Coastal States Energy*** has begun operations at the Skyline No. 1 mine in Eccles Canyon near Scofield in Carbon County. Production from this mine is expected to reach 400,000 short tons in 1982. Two other mines are planned in Eccles Canyon. Skyline is a joint venture of ***Coastal States Energy and Getty Mining Co.***[1]

Copper-Gold-Silver – Tintic Division of ***Kennecott Minerals*** may have found a new silver and gold ore body about 1,700 feet south of the Trixie shaft in Utah County. Mineralization was also reported 2,700 feet to the south. If water studies are favorable, Kennecott plans to proceed with the shaft development.

Sohio and Kennecott Minerals plan to invest up to $1 billion by 1986 to modernize ore crushing and ore hauling facilities for the Bingham Canyon Mine, in Salt Lake County, and to replace three concentrators now in use.[2]

Johnson Matthey Investments Inc., has begun construction of a gold and silver refinery at 3900 W. 2100 S. in Salt Lake Valley, with completion planned by late 1982. Installed capacity will be one million ounces of gold, 4 million ounces of silver, and 400 tons of low grade materials per year.[1]

Anaconda announced that it will reduce its work force of 900 by 100 and will temporarily suspend operations of its mine, mill, and concentrator at Carr Fork near Tooele in Tooele County. Development work will continue. The company has had problems with highly fractured ground and old workings, as well as the low copper prices. The company says that operations may resume in a year.[2]

Kennecott Mineral's Utah Copper Division is also reducing its staff by more than 600 as a result of the copper industry depression that started in 1978. The high cost of installing pollution control facilities, the decreasing copper content of the ore (which averaged 19.5 pounds per ton in 1947 and now averages only 11 pounds) and dropping metal prices have all hurt the company. Utah Copper, which employed 7,400 in 1981, is claimed to be Utah's largest industrial employer.[3]

Noranda Mines Ltd. has laid off another 55 employees (55 percent of its work force) at its United Park City operation. Development work in the Ontario mine has stopped; exploration drilling will continue.[1]

Molybdenum – ***Pine Grove Associates*** is continuing assessment drilling at its property in SW Utah; ***Phelps Dodge Corp. and Getty Oil***, joint owners, will make a decision about mining the property at the end of 1982.[1]

Gems – ***The Wasatch Gem Society*** has been granted a new lease to 40 acres of State Land near Topaz Mountain in Juab County.[1]

Potash – ***Elf Aquitaine*** of France has now acquired full control of Texas Gulf, Inc., Cane Creek potash mine near Moab in Grand County.

Synfuels – Utah received $48.5 million from the Bureau of Land Management as its share of the oil shale lease monies impounded since 1974. This is 37½ percent of the total; the state is appealing for a 50 percent share (the share it now gets of mineral lease and royalties received by the Bureau of Land Management from users of federal lands). Interior Secretary James G. Watt ruled that Utah was entitled to only the 37½ percent.[1]

Uranium – ***Atlas Corporation*** was forced by the depressed uranium market to lay off about 175 miners and millers in the Moab area. The alkaline uranium circuit at the Moab Mill will be temporarliy closed, while the more cost-efficient acid uranium recovery circuit will be kept in operation. The Calligham mine near Moab and the Snow and Provo mines near Green River will be on standby. The Paradox mine near La Sal will cut production. Atlas says it will continue an agressive uranium exploration program.[4] ■

Sources: [1] Utah Mining Association *Management Digest*, 1981.
[2] *The Salt Lake Tribune.*
[3] *Deseret News.*
[4] *Moab Times - Independent.*

New Publications

From Utah Geological & Mineral Survey:

- ***Utah Mineral Industry Activity Review and Summary of Oil and Gas Drilling and Production, 1980,*** by Martha Ryder Smith and Karl W. Brown, Utah Geological and Mineral Survey Circular 71, December 1981, 31 p., 16 figs., 20 tables, price is $3.00 over-the-counter.

- Map 59, ***Complete Bouguer Gravity Anomaly and Generalized Geology Map of Richfield 1° x 2° Quadrangle, Utah, December 1981,*** by Kenneth L. Cook, Jopie I. Adhidjaja and Stephen C. Gabbert, scale 1:250,000 (25 x 40 inches), multiple colors, available for $5.00 over-the-counter.

- Map 64 (2 sheets), ***Land Control and Coal Reserves of the Wasatch Plateau Coal Field and Emery Coal Field, Utah, March 1982,*** by S. N. Sommer, H. H. Doelling and Archie D. Smith sheet 1 includes the "Northern Wasatch Plateau Coal Field," sheet 2 includes the "Southern Wasatch Plateau and Emery Coal Field;" scale 1:31,680 (each sheet is 24 x 32 inches), two colors, both sheets are available for $10.00 over-the-counter, or $5.00 for individual sheets. Map 64 is a complete revision of Map 48B, Map 48C is currently being revised and should be available after June 1, 1982.

- Map 66, ***Coal Fields of Utah, May 1982,*** by Hellmut H. Doelling; scale 1:1,000,000 (20½ x 25 inches), multiple colors, available for $1.50 over-the-counter. Map 66 is a reprint of Map 20-A, all active coal mines in the state have been added.

From Utah Geological Association:

- ***Central Wasatch Geology, 1981: Illustrated Road Logs with Abstracts,*** edited by Bruce N. Kaliser and Duane L. Whiting, Utah Geological Association Publication 9, September 1981, 46 p., 35 figs.; price is $3.50 over-the-counter. ■

Orders must be pre-paid. Postage rates: Orders less than $10.00, add $1.50; $10.00 - 24.99, add $3.00; $25.00 $100.00, add $5.00; more than $100.00, add $10.00; add $1.50 for tube for rolled map (maximum of four map sheets per tube).

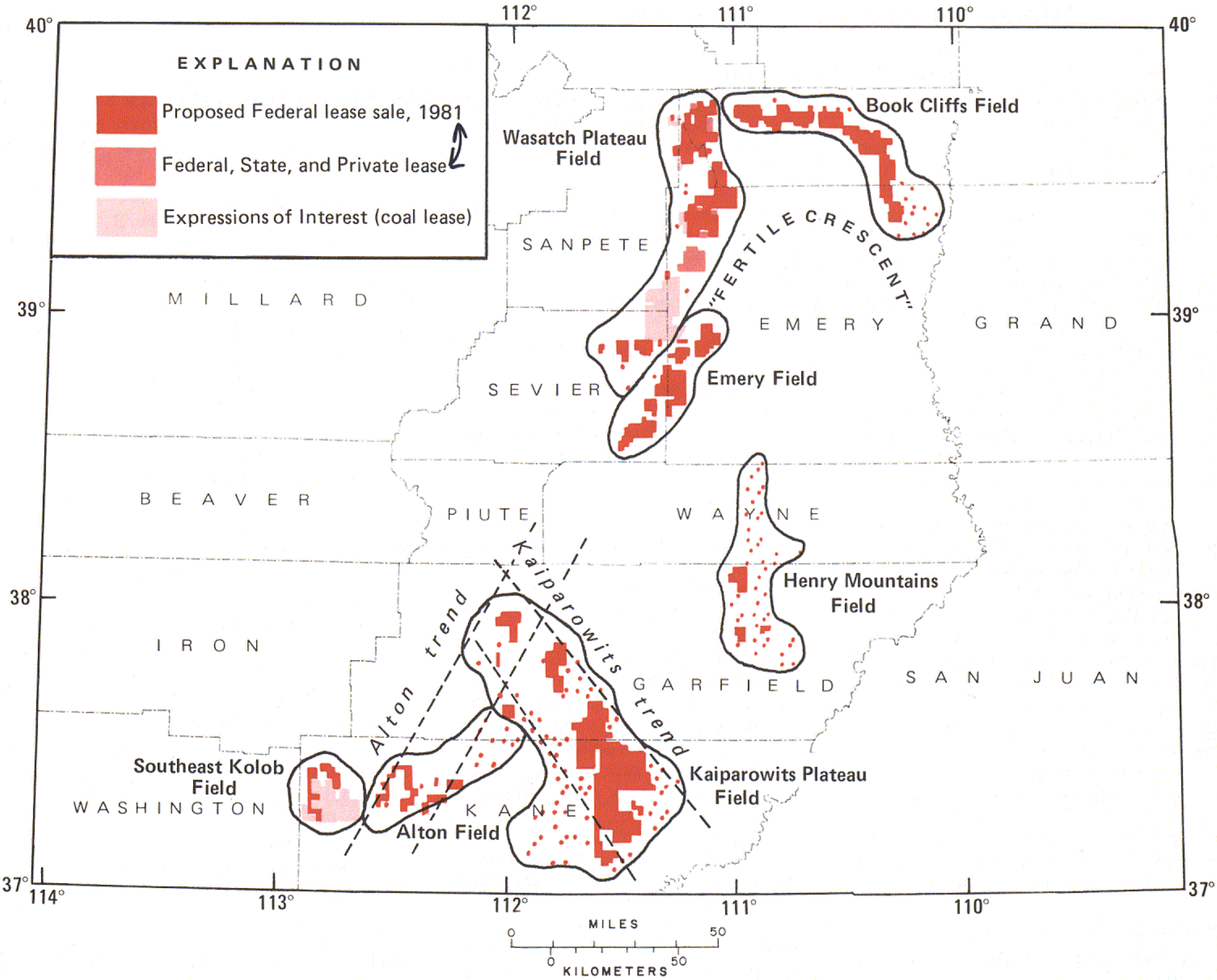


FIGURE 1. "Fertile Crescent" coal fields and southwestern Utah coal fields.

("Utah's Fertile Coal" cont. from page 1)
mercial, and transportation markets. During this time railroad locomotives were completely dieselized and most people converted the heating systems in their homes to use petroleum or natural gas rather than coal. Toward the end of this "boom" not even the thriving steel industry could keep Utah's annual coal production rate above six million short tons.

During the 1960s Utah's coal industry suffered a second depression as the direct result of declining markets in industry and in space heating. Even the schools and other public institutions converted their boilers from coal to petroleum or natural gas. An oil glut and artifically low petroleum prices accelerated the decline of coal usage. Only the need for coking and metallurgical coal by the steel industry and the need for coal by industries that could not convert to oil or gas, kept the coal industry going. By 1970 only 1.4 million short tons were consumed by industry for space heating. The coal depression in Utah lasted from 1958 to 1972 (15 years), until just before the Arab oil embargo took place. The average annual production during this depression was 4.7 million short tons and many smaller, less efficient coal mines closed down.

The increasing per capita use of petroleum in this country, in spite of rapidly declining domestic petroleum reserves, became evident to energy companies during the 1960s and they turned their attention back to coal. In comparison to the eastern coal resources of the United States, western coal resources had barely been touched and the American west became a prime target for coal exploration. By the late 1960s the new mines opening in Utah's neighboring states were producing from very thick coal beds that extended over large areas and had only minimal overburden. Virtually every coal company was looking to develop strip mines because of the lower mining costs. The rapid development of these mines instigated environmental concerns and finally interest was extended to underground development as well. Utah's potential for strip-mining is limited in her "fertile coal crescent"

(see page 10)

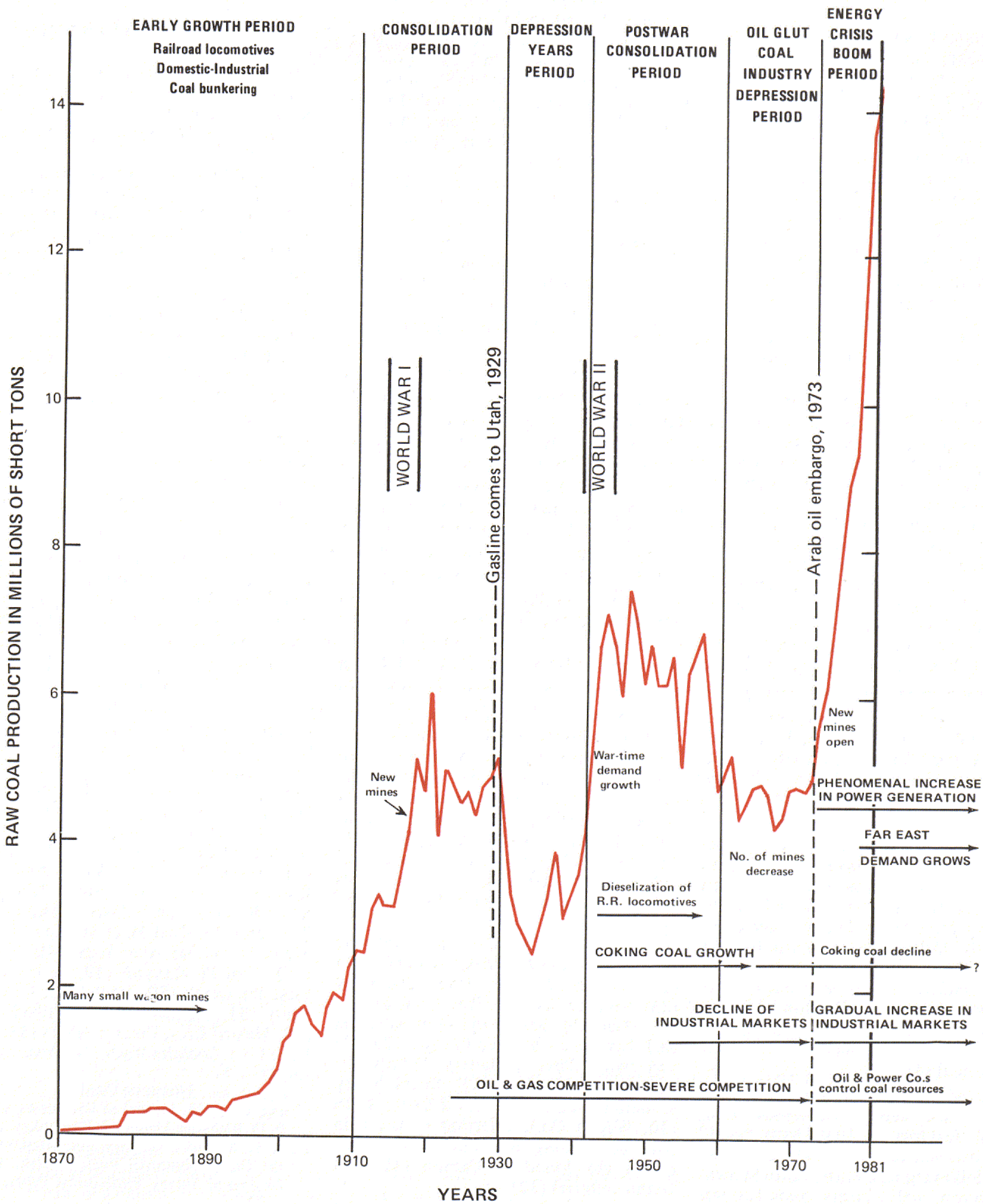


FIGURE 2. Utah raw coal produciton, 1870-1981, indicating historical events that have influenced the coal industry in Utah.

UGMS Staff Changes

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Richard L. Barker has joined UGMS as the accounting clerk typist, replacing **Joy Jones** who transferred to the Utah Board of Education.

Alexander C. Keith has recently been added as a geologist to the Energy Section. He received his B.A. degree in geology from Hamilton College in 1976. Alex moved to Utah in 1979 when he enrolled at the University of Utah in the Geology and Geophysics Department. He has spent the last six months working for Gulf Resources and Chemical Exploration Company in Kellogg, Idaho. Alex's departmental responsibilities include compilation of coal resource data and the coal geology of the Henry Mountain Basin.

Steven N. Sommer graduated from Madison High School, Rexburg, Idaho, in 1965. He has worked for the U.S. Forest and California Fish and Game Department, and has earned a B.S. degree in natural resources with a minor in geological oceanography from Humboldt State University, Arcata, California, in 1973. He worked as a geological intern for 14 months at the UGMS before accepting a permanent position as a geological technician in the Energy Section.

Dan A. Foster graduated from Bowling Green High School, Bowling Green, Kentucky, in 1974. He has had extensive experience in botany and wildlife research with emphasis in rare, threatened, and endangered species. He graduated from BYU in 1981 with a composite degree in wildlife resources and range management with a minor in geology. Dan joined the Energy Section last December, as a geological technician.

Kathy Lynne Hardin is the latest arrival to the Energy Section. She is a Junior majoring in Geology at Brigham Young University. Kathy was born in Peoria, Illinois and raised in Lambertville, Michigan. ■

TiO_2 VALUES CORRECTED

The report in the November 1981 *Survey Notes* article on igneous dikes in the eastern Uinta Mountains requires correction in the percent titanium oxide obtained in analyses of four samples of dike rock from two localities on the east border of the High Uintas Primitive Area.

The TiO_2 value of these samples is off by a factor of approximately 5. Range of TiO_2 in the four samples was 4.34 percent to 4.77 percent. The erroneous data appear on page 13, *Survey Notes*, November 1981, in the article entitled: "Dike Investigation Helped By Chopper Lift". ■

NON-FUEL MINERAL PRODUCTION IN UTAH, 1981

By MARTHA RYDER SMITH

Preliminary data from the U. S. Bureau of Mines indicates that Utah's non-fuel mineral production in 1981 increased by $14 million dollars over that of 1980.

The total value of metals produced in 1981 was $617 million, up from $606 million in 1980. Production of copper, gold, silver, and molybdenum, down in 1980 due to the prolonged copper strike, was up in 1981. However, the values of the metals produced in 1981 do not reflect the real increase in production because of the drop in metal prices. Active exploration and development of gold, silver and molybdenum properties continued throughout the year.

In the non-metals group, preliminary data show that production of clay, gypsum, pumice, and stone dropped slightly, while that of lime and salt increased. Leading nonmetallic commodities include portland cement, potash, salt, lime, sand and gravel, and gilsonite.

The accompanying table on page 9 shows the non-fuel mineral production and values for metals and non-metals for the past five years. Production figures for some commodities are withheld (W) to protect proprietary data. ■

("Utah Toponyms" cont. from page 4)

other Utah "coal" counties, Emery and Sevier, experienced even greater population boosts, (Emery, 122.9 percent, from 5,137 to 11,451 people; Sevier, 45.8 percent, from 10,103 to 14,727).

Coal City (**3**, Carbon Co.), 9 miles west of Spring Glen, emerged in 1921 on the map but disintegrated in 1935 when coal production sharply declined due to the Depression and, finally, was abandoned by 1940. Another ghost town is Carbon (Carbon Co.), formerly known as Heiner (named for Moroni Heiner). One recreation site on Diamond Creek, approximately 23 miles south of Springville (Utah Co.), is named Coal Mine Campground (**4**).

In addition to these cultural coal-bearing place names, numerous other physical features in Utah have "coal" names attached to them. While almost all of the following names are found in areas with known coal deposits, some features carry "coal" names mistakenly. For example Coal Hollow (**5**, Weber Co.) and Coal Bank Springs (**6**, Box Elder Co.) are not associated with a coal field but run over black shale. Another Coal Hollow (**7**), located some 8 miles NE of Randolph (Rich Co.), runs by a phosphate mine where no known coal deposits exist.

In addition to the above mentioned Coal hollows there are eight more, making it the most numerous "coal" name in the state. It occurs in the following counties: Kane (**8**, **9**), Morgan (**10**, **11**), Salt Lake (**12**), Sevier (**13**), Utah (**14**), and Washington (**15**). One Coal Hollow Spring is located in Utah County (**16**).

The name Coal Canyon is used nine times: Carbon (**17**), Emery (**18**), Garfield (**19**), Grand (**20**, **21**), Iron (**22**), Kane (**23**), Sanpete (**24**), and Wasatch (**25**).

Garfield and San Juan counties each have one Coal Bed Canyon (**26**, **27**) and two valleys in Emery County are named Coal Wash (**28**, **29**). In the Henry Mountains region we find a Coaly Wash (**30**, Wayne Co.), referring to the thin coal beds along the wash. Two Coal creeks are found in Carbon (**31**) and Grand counties (**32**).

Research from the USGS 7.5 and 15 minute topographic quadrangle sheets show that all other "coal" names appear only once as a landform or drainage feature on Utah's map. They include the following names: Coal Bed Mesa (**33**, Garfield Co.), Coal Bed Spring (**34**, Uintah Co.), Coal Bench (**35**, Garfield Co.), Coal Canyon Bench (**36**, Grand Co.), Coal Cliffs (**37**, Emery Co.), Coal Creek Bench (**38**) and Coal Draw (**39**) in Grand Co., Coal Fork (**40**, Sanpete Co.), Coal Hill (**41**, Washington Co.), Coal Mine Basin (**42**, Uintah Co.), Coal Mine Creek (**43**, Sevier Co.), Coal Mine Draw (**44**, Duchesne Co.), Coal Mine Hill (**45**, Summit Co.), Coal Mine Hollow (**46**, Wasatch Co.), Coal Mine Spring (**47**, Box Elder Co.), Coal Mine Wash (**48**, Wayne Co.), Coal Pit Canyon (**49**, Tooele Co.), Coal Pit Creek (**50**, Utah Co.), Coal Pit Wash (**51**, Garfield Co.), Coalbed Pass (**52**, Millard Co.), Coalpit Gulch (**53**, Salt Lake Co.), Coalpits Wash (**54**, Washington Co.). ■

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Hunt, C. B., 1953, Geology and Geography of the Henry Mountain Region, Utah: U. S. Geological Survey Professional Paper, 228, p. 22.

Leigh, R. W., n.d, Five Hundred Utah Place Names: Deseret News Press, Salt Lake City, 109 p.

Branch of Geographic Names, 1981, Utah Geographic Names: U. S. Geological Survey, Reston, Virginia, p. 75-76.

Non-fuel Mineral Production in Utah, 1977-81 (values in thousands).

Commodity	Unit	1977	1978	1979	1980[3]	1981[2]
Metals						
Copper[1]	metric tons	176,111	186,330	193,082	157,775	211,000
	values	$259,357	$273,175	$396,003	$356,251	$395,000
Gold	troy ozs.	210,501	235,929	260,916	179,538	229,900
	values	$ 31,219	$ 45,664	$ 80,232	$109,978	$107,200
Iron Ore	1,000 long tons	1,932	1,961	1,618	1,307	W
	values	$ 19,780	$ 21,224	$ 19,391	$ 18,540	W
Lead[1]	metric tons	9,749	2,541	W	W	1,700
	values	$ 6,598	$ 1,888	W	W	$ 1,500
Silver[1]	1,000 troy ozs.	3,283	2,885	2,454	2,203	2,886
	values	$ 15,169	$ 15,579	$ 27,216	$ 45,476	$ 31,750
Tungsten	1,000 lbs.	27	11	W	W	W
	values	$ 219	$ 80	W	W	W
Zinc[1]	metric tons	16,111	3,509	W	W	1,600
	values	$ 12,218	$ 2,398	W	W	$ 1,600
Non-metallics						
Clays	1,000 short tons	244	265	355	365	332
	values	$ 713	$ 913	$ 1,246	$ 1,517	$ 1,362
Gypsum	1,000 short tons	324	316	772	287	278
	values	$ 2,510	$ 2,777	$ 6,552	$ 2,612	$ 2,631
Lime	1,000 short tons	209	225	198	259	332
	values	$ 8,274	$ 7,196	$ 8,250	$ 13,293	$ 17,721
Pumice	1,000 short tons	W	28	28	35	34
	values	W	$ 270	$ 280	$ 347	$ 350
Salt	1,000 short tons	843	956	1,204	1,157	1,215
	values	$ 10,831	$ 13,532	$ 14,723	$ 19,373	$ 22,401
Sand & Gravel[4]	1,000 short tons	11,895	12,580	10,363	8,906	9,000
	values	$ 18,662	$ 21,840	$ 18,621	$ 17,234	$ 17,700
Stone	1,000 short tons	2,765	2,817	3,424	2,919	2,669
(crushed)	values	$ 7,072	$ 9,716	$ 11,059	$ 11,776	$ 11,142
Stone	1,000 short tons	6	7	5	3	3
(dimension)	values	$ 238	$ 264	$ 216	$ 272	$ 270

Mineral for which production is not revealed: beryllium, carbon dioxide, cement, gilsonite, magnesium compounds, magnesium metal, molybdenum, phosphate rock, potassium salts, sand and gravel (industrial), sodium sulfate, sulfur, uranium, and vanadium.

[1] Recoverable content of ores.
[2] Preliminary figures.
[3] 1980 production of copper, gold, and silver were down because of a copper industry strike. Most of the gold and silver, as well as molybdenum, and other metals are produced as by-products of the copper.
[4] Excludes industrial sand and gravel.

Source: U.S. Bureau of Mines Yearbooks 1977,78,79, and 80 and Mineral Industry Survey, *The Mineral Industry of Utah in 1981,* Annual Preliminary, Janurary 22, 1982.

("Utah's Fertile Coal" cont. from page 6)

because of the thick overburden overlying the coal beds (Figure 4). Utah has some of the deepest coal mines in the U. S. (2,500-3,000 feet beneath the ridges) and the mining costs are correspondingly higher. Utah, however, is compensated somewhat by having some of the best coals in the west. "Best in the West" is an honest appraisal of Utah's coal quality. Utah coals fare better economically when a longer transport equalizes the difference in mining costs (Plate 1).

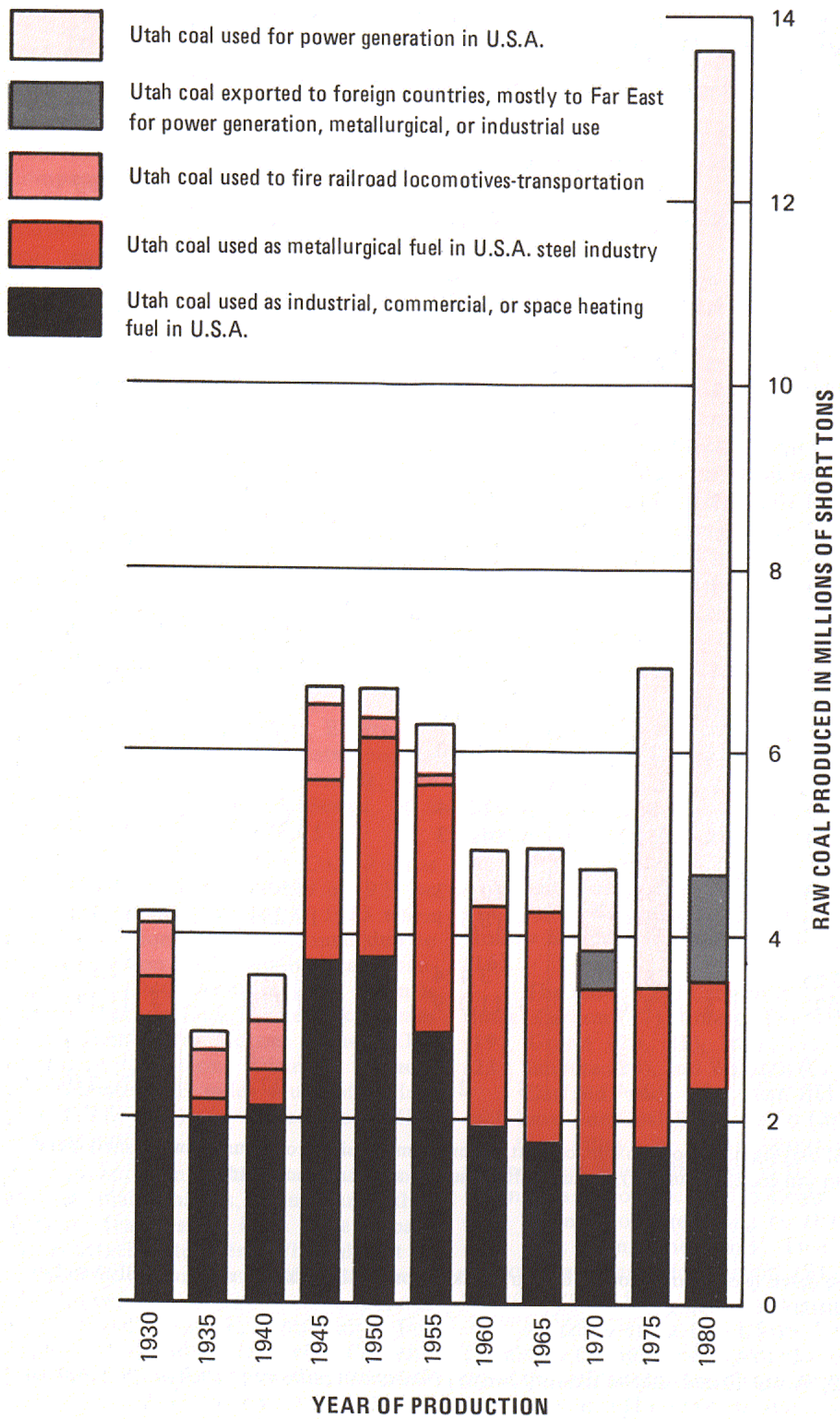


FIGURE 3. Utah coal production related to coal use shown in five year increments, 1930-80.

The current coal "boom" started in 1973 and increases in the annual production rate continue to the present. Most of the rise is due to increased use by the electrical power generating industry in Utah, Nevada, and in other states (Figure 3). Before 1970 coal use by this industry was relatively small, but it has increased manyfold since then. The growing electrical power generating industry will certainly require an even greater share of the coal in the future. Although far less important, industrial and commercial market usage has shown modest increases since 1973, especially by the cementproducing industry. Most recently, Far East users of coal, representing a variety of markets, are taking advantage of Utah's high quality coal. This market continues to grow. On the negative side, the domestic steel industry continues to decline and its use of coking coal decreases with it. Production statistics illustrate the importance of the use of coal by the electrical power generating industry without it, production would still be holding at the oil glut depression period levels of a little over four million short tons per year (Plate 2).

In 1981, 39.1 percent of Utah coal was consumed in-state, another 38.3 percent was shipped to other states, primarily to Nevada and California, and 22.6 percent was transported to the Far East and Canada. About 60 percent was used to generate electricity, 27 percent was consumed for industrial purposes, 11 percent was used for metallurgical purposes and three percent for space heating in both commercial buildings and homes. The comparison of these figures with those for 1980 (Figure 3) shows the great increase in the amount of coal exported in the last year.

Forecasts of Utah production made in 1970 for 1980 ranged from 8 to 30 million short tons. Many of the projects slated for construction in 1970 were abandoned or delayed because of environmental and permitting regulations, inflation, or a slower than expected demand for coal. Forecasts presently being made for 1990 range from 17 million short tons to as high as 60 million short tons. Prospective users include several newly-to-be-constructed power plants, synfuels plants, and additional markets in the Far East.

The steady rise in production has now persisted for nine years. How much longer will it continue to climb before levelling out? The gradual increase in export and industrial coal demand is expected to continue, at least until 1985. As large power generating units are completed, large upswings in coal production are anticipated. Between 1985 and 1990 there should be some sharp increases as new power generating units or synfuels plants come on line. We believe that coal production will increase to approximately 17 and 20 million short tons on an annual basis by 1985 and may reach 22 to 27 million short tons by 1990. A levelling out may occur thereafter.

The historical dominance of Utah's "fertile crescent" as a coal producing region is evident from Figure 5 (see page 14), but some shifts are occurring. Through 1981, 70 percent of Utah's coal had been produced in Carbon County, 24 percent in Emery County, and 3.2 percent in Sevier County. However, Utah coal production, during the last ten years of that history, shows Carbon County leading with only 47 percent, and Emery and Sevier counties producing 40.9 and 12.1 percent, respectively. Considering the three coal fields of the "fertile coal crescent," through 1981, 57.6 percent of Utah coal has come from the Book Cliffs coal field, 39 percent from the Wasatch Plateau, and only 1.4 percent has come from the Emery coal field. In the 1970-81 period 30.4 percent was mined in the Book Cliffs, 65.1 percent came from the Wasatch Plateau, and the Emery coal field portion increased to 4.3 percent.

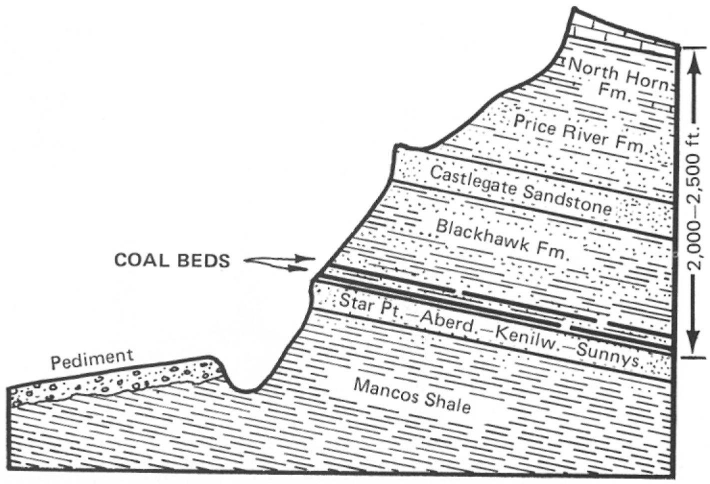
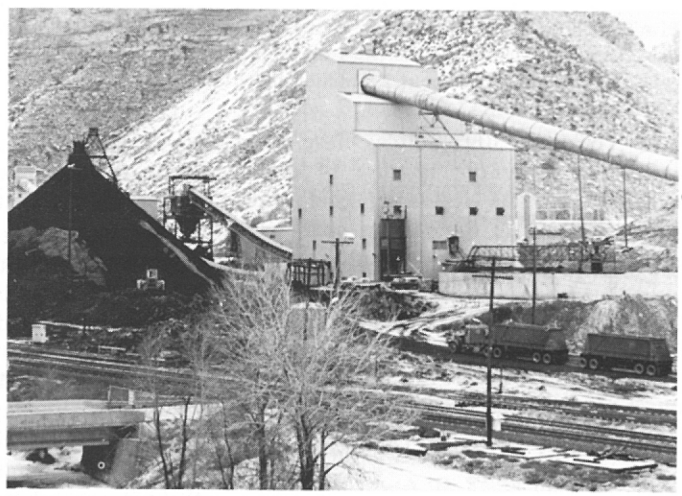


FIGURE 4. Diagrammatic sketch showing cross-section of Book Cliffs or Wasatch Plateau, indicating the general stratigraphy and position of coal beds with respect to topography Overlying strata are stacked thickly over the coal beds precluding any opportunity for strip-mining.



Hellmut H. Doelling

PLATE 1. Elaborate loading facilities for coal are a sign of a thriving coal industry. Unit loading facilities have sprung up at many locations in central Utah and thousands of coal trucks move along its highways.

UGMS COAL RESEARCH PROJECTS

The Utah Geological and Mineral Survey has provided coal resource data since 1964. Previously published literature on Utah coal was collected and staff geologists mapped exposed coal beds in areas where no published data were available. Industry was contacted to obtain analyses and drill-hole information. Areas were examined on a quadrangle by quadrangle basis and a primary resource base was determined for the state. A determination of 24.3 billion short tons in place was based on reasonably continuous coal beds four or more feet thick, and under less than 3,000 feet of overburden. The distribution of those resources, by county, is shown in Figure 6 (see page 14). UGMS research in past mining practices indicates that about one-third of that amount will be mineable and recoverable. These data were published in three hard-bound volumes known as the "Coal Monographs," which are now almost out-of-print. They were published just before the energy crisis boom period began and have assisted government planners and industry alike as the coal "boom" gained momentum.

Since that time UGMS has engaged in many areas of coal research. Areas of the Henry Mountains coal field were mapped and coal exploration drilling was carried out in several areas of the Wasatch Plateau coal field. Assistance has been provided to coal researchers from academic institutions, industry, and other government agencies. These researchers have made important strides in unravelling the "environments of deposition" of the Utah coal beds and the rocks that encase them.

In more recent years, UGMS coal geologists have been made aware of the need for more research into correlation problems of the coal itself, and its associated strata. Presently the Utah Geological and Mineral Survey is conducting or sponsoring research to study roof control, coal bed structures, floor control, coal microscopy, methane content of coal, data management, and areal distribution of coal. Some of this research is discussed in the following paragraphs.

Methane Content of Utah Coal – The study of the methane content of Utah coal commenced in 1976 and is still being addressed by UGMS. Basic data continue to be collected from every drill-site made available for coring. Coal core is collected at the drill site and sealed within a gas-tight container after which gas emission is measured for two hours on an intermittent basis to determine "lost gas" ("lost gas" is that which is lost while bringing the core to the surface and while sealing the sample in the gas-tight container). The sealed sample is then returned to the laboratory, where gas emission is measured on a daily basis until the core is completely desorbed. The core is considered desorbed when less than 10cm^3 can be measured per day over a period of one week. Then the sample is removed from the container, ground up in another air-tight container, and the released residual gas measured. The three gas components (lost, desorbed, and residual) present a reasonably accurate summation of the amount of gas in the coal. Such basic data can be used to plan mine ventilation and to determine the feasibility of economically recovering the gas.

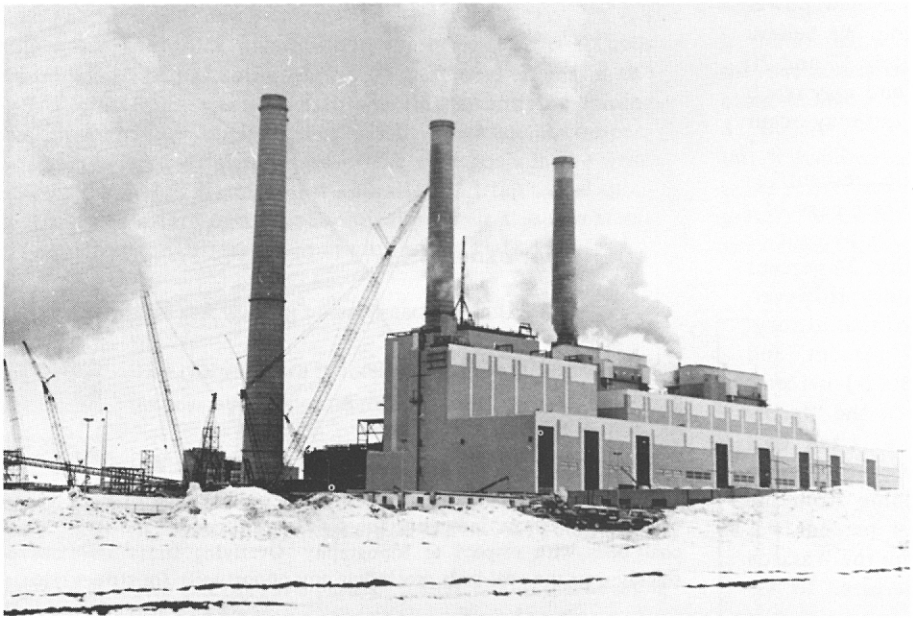

Hellmut H. Doelling

PLATE 2. The electric power generating industry uses most of Utah coal. As generating units are completed, significant increases occur in the annual production rate. Each 500 Megawatt generating unit requires about 1.5 million short tons of coal annually.

To date, 309 samples have been collected at random because of donor dependency. The following coal cores were collected in the various coal fields and tested for methane content:

Book Cliffs	113 samples
Wasatch Plateau	61 samples
Emery	60 samples
Sego	33 samples
Kaiparowits Plateau	12 samples
Alton	3 samples
Henry Mountains	1 sample

Sufficient numbers of samples have been collected in the Book Cliffs coal field to infer but not completely delineate an area of gassy coal. The data for this area were published by H. H. Doelling *et al*, in Special Studies 49 (1979), and are also treated in Archie Smiths' UGMS Open-file Report No. 29 (1981).

Some core samples release most of their methane content in the "lost" and "desorbed" periods of the measurement; others release little gas until they have been ground. Samples collected in the northwest corner of the Book Cliffs coal field indicated that 18 percent were low gassy until the residual gas content was measured. These samples contained 97 percent of their gas as residual gas. This observation is of interest because the cleat (principle jointing in a coal seam) could be observed in the samples. No microscopic observations could be made to explain the ability of the samples to retain the gas. Microscopic examinations are underway to study the phenomenon.

Wasatch Plateau coal field samples and samples collected in other fields show little methane gas content. New coal areas may still be found in the state in which the coal is gassy. Wasatch Plateau coal samples have little or no residual gas content, which may indicate that the coal has the ability to drain itself naturally. In coal mining operations, gas is released as the mining machines expose and grind the coal. If desorption is not carried out in advance of mining in gassy coal areas and if special ventilation systems are not put into operation, gas concentrations can rise to such dangerous levels that production must be stopped. It is estimated that millions of cubic feet of methane gas (950 Btu/ft^3) are being vented into the atmosphere each day from Utah mines. At present, industry is investigating the possibility of economically recovering this gas along with overcoming the legal problems associated with gas production.

Utah Coal Data Management

In recent years a great amount of point source data has been generated from measured sections and drill holes and their respective lithologic or geophysical logs. These data are stored in a variety of places: State, Federal, private, and industry files. Consequently, the data are hard to handle, in variable formats, or difficult to obtain.

Presently, the Utah Geological and Mineral Survey is compiling, collecting, interpreting, and soliciting data for input into a computer system developed by the U.S. Geological Survey, namely the National Coal Resource Data System (NCRDS). As requested by some contributors, the detail of these data can be kept confidential. This assured confidentiality is to encourage coal companies or private sources to make their point source information available to UGMS. These data can be used to reach regional conclusions or can provide the broader resource base necessary for accurate evaluation of the geology, structure, or resource. NCRDS is an interactive computerized storage retrieval, and display system, which greatly expands information capability when confronted with large volumes and various types of data. A propsed graphic computing system with a hard copy unit would enable UGMS to make sound resource estimates quickly. In addition, data could be displayed graphically as tables, isoline maps, cross-sections, and as correlation charts. The system software will allow the generation of overburden, interburden, and isopach maps, as well as maps based on other selected parameters.

Data entered into the system will include: County name, coal bed name, bed thickness, depth of overburden, and data reliability. Quality data to be included are: Proximate and ultimate analyses, heat value, ash softening temperature, free-swelling indexes, and Hardgrove Grindability Indexes.

Regional Coal Mapping

The Utah Geological and Mineral Survey is participating in a U.S. Geological Survey program to map coal resources on a 1:100,000 scale folio series with the intent of permitting a synoptic overview. The first area to be mapped is the Henry Mountains coal field, which has recently been the subject of an unsuitability study conducted by the U.S. Bureau of Land Management (BLM). Environmental concerns of the state of Utah included the potential impacts of development on Capitol Reef National Park and its vistas and the potential impact on the critical range required for the unique free roaming bison herd, which inhabits the area. Geologic studies

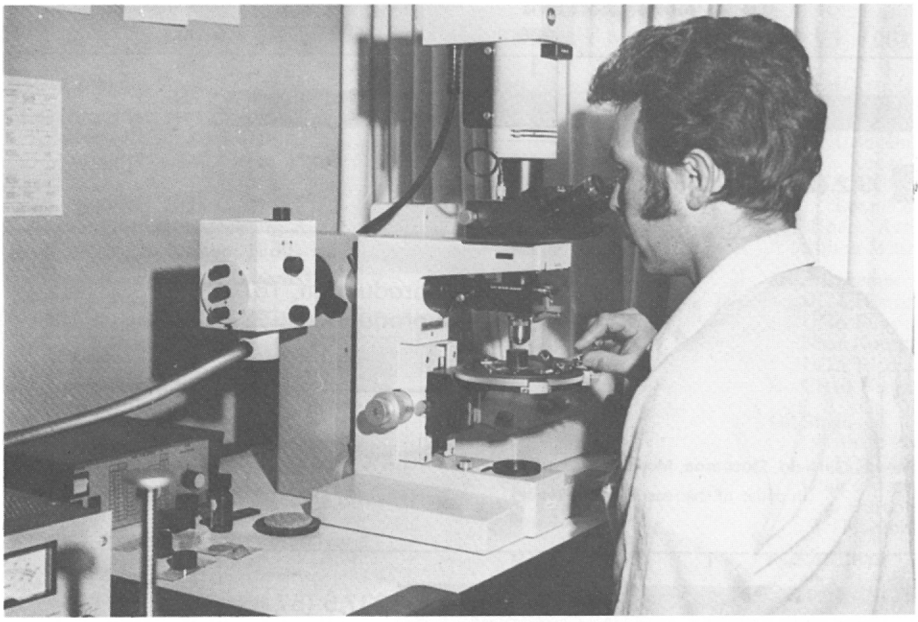

Hellmut H. Doelling

PLATE 3. Utah Geological and Mineral Survey geotechnicians use sophisticated apparatus to examine Utah coals and to unravel its mysteries.

improve the information base on which decisions are made. The mapping of the coal in the Henry Mountains basin is certainly a high priority of UGMS.

Data from the literature will be verified and detailed mapping of key areas will examine coal outcrops to determine their correlation, lateral continuity, structure, and geometry. Accompanying maps will delineate individual coal beds, interburden and overburden isopachs, land ownership of control and coal quality. A drilling program may be instigated where data are most needed.

UGMS has and continues to sponsor graduate student's mapping of quadrangles in the coal areas. Such projects have been completed in the Wasatch Plateau, Book Cliffs, and Sego coal fields. Additional field projects are planned for the Henry Mountains coal field and the Sego coal field.

Coal Mine studies

One BYU graduate student, Mark Bunnell, assisted by UGMS, has investigated the geology of several Utah mines with emphasis on the geologic aspects of gassy coal and roof control, his findings will be published by UGMS later this year. Mine roof characteristics have been projected into proposed mining areas and studies are shedding new light of the geological factors of coal which affect mining.

Coal Petrography

The capability of the Utah Geological and Mineral Survey to examine Utah coals has been greatly enhanced with the acquisition of a Leitz Ortholux II microscope equipped with a compact MPV photometer and electronic console for read-out (Plate 3). The microscope is equipped with a mercury lamp for fluorescence work and an automatic camera system for microphotography. Two geotechnicians work with the equipment full time to determine the vitrinite reflectances and maceral inventories of polished coal billets prepared from the many coal core samples in the UGMS sample library. All work is done to the American Society for Testing and Materials (ASTM) standards. At present, UGMS coal petrography work is a corollary of specific work for a federal grant. In the future, UGMS may expand its studies and automate and computerize this equipment.

There are many applications of coal petrography, "maceral analysis and reflectance analysis characterize coal so well that they can be used to predict the behavior of coal in any technological process of inerest" (Crelling and Dutcher, 1980, p. 43). The Utah Geological and Mineral Survey is exploring some of the potential applications of this tool, and expects to vigorously continue this type of coal research in the future.

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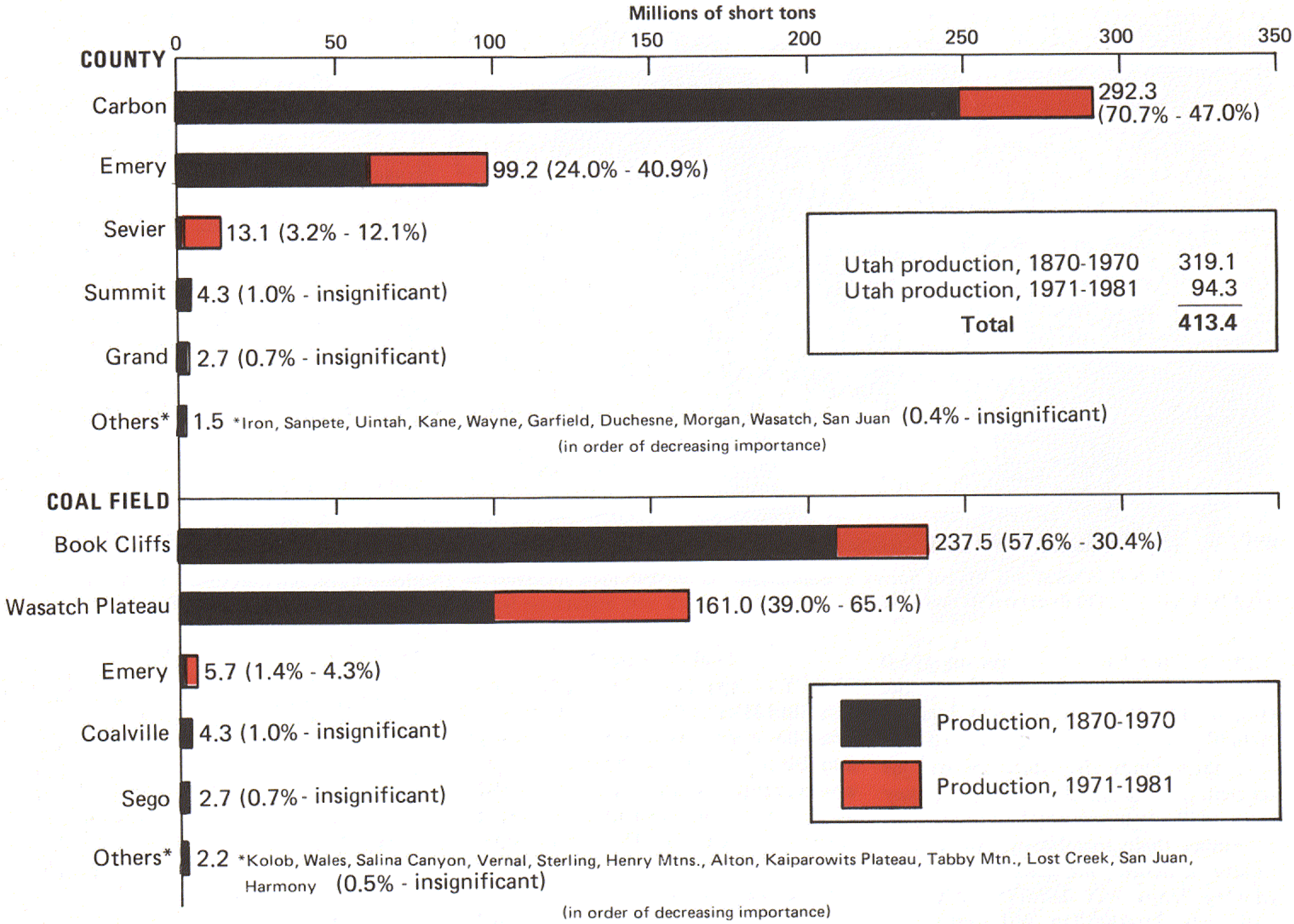

FIGURE 5. Coal production, by county and coal field, 1870-1981. First percentage figure is for total production; second percentage figure is for 1971-81 production.

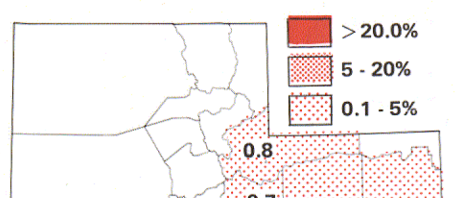

FIGURE 6. Utah counties with respect to known mineable coal resources in percent of total Utah resources under less than 3,000 feet of cover and in beds 4 feet or thicker.

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SURVEY NOTES, VOLUME 15, 1981

NCIC and UGMS

Did you know that. . the UGMS is an affiliate of the USGS's National Cartographic Information Center?

NCIC is a focal point for the collection, organization, and dissemination of information concerning the availability of cartographic data in the U.S. Cartographic data not only means maps and charts both old and new, but also aerial photography and space imagery (Landsat), geodetic control data, and map data in digital form.

As an NCIC affiliate the UGMS acts much like NCIC except its focus is availability of cartographic data for the state of Utah, not nationwide. The services available are:

1. **Space Imagery** - Computer listings of Landsat imagery including coverage, quality, cloud cover for all bands; availability of computer compatable tapes and False Color Composites, availability of Skylab imagery.
2. **NASA Photography** - Listings of state wide coverage with details such as location, quality, sensor, etc.
3. **Aerial Photography** - UGMS can research availability of photography for your area of interest from photography generated by more than 30 federal agencies, state agenices, and commercial firms. The UGMS can also provide information on photography that is in progress.
4. **Topographic Maps and Charts** - UGMS can provide information on preliminary and published maps, and orthophoto quads. You can examine the file copy in the UGMS library.
5. **Historical Topographic Maps** - You can view on 35mm microfilm all of the out-of-print standard topographic maps ever produced by the USGS National Mapping Division. Also included, are many of the U.S. Corps of Engineer maps.
6. **Digital Data** - UGMS can direct you to the proper sources for inquiries about digital map data availability and applications.
7. **Mine Maps** - UGMS has microfiche of maps of inactive coal mines.
8. **EROS Data Center Photographic Data Base** - This data base contains over 6,000,000 frames of imagery and photography. UGMS can initiate customized searches, tailored to your specifications, and print-outs will be furnished to you itemizing those products that fulfill your specifications.

So in a nutshell, if you have any questions about what is available, where can I get it and how much does it cost regarding cartographic data in Utah, contact Mage Yonetani, UGMS, 606 Black Hawk Way, Salt Lake City, Utah 84108; telephone (801) 581-3058. ■

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UTAH GEOLOGICAL AND MINERAL SURVEY
606 Black Hawk Way
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